

UPTAKE CADMIUM (Cd^{2+}) BY ZnAlCO_3 HYDROTALCITE

AZINYANA BINTI SHAWAL

**Final Year Project Report Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Chemistry
in the Faculty of Applied Sciences
Universiti Teknologi MARA**

NOVEMBER 2007

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	vi
ABSTRACT	x
ABSTRAK	xi
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Hydrotalcite	2
1.3 Problem statement	6
1.4 Significance of study	6
1.5 Objectives of the study	7
CHAPTER 2 LITERATURE REVIEW	
2.1 Background	8
2.2 Cadmium	8
2.3 Hydrotalcite (HT)	9
2.4 Factors that effect precipitation on hydrotalcite	12
2.5 Adsorbent	13
2.6 Structure of Hyrotalcites	16
CHAPTER 3 MATERIALS AND METHODS	
3.1 Background	18
3.2 Material	18
3.2.1 Chemicals	18
3.2.2 Characterization	18
3.2.3 Analysis	19
3.3 Method	19
3.3.1 Synthesis of $\text{CO}_3\cdot\text{Zn-Al}$ LDH	19
3.3.2 Removal of heavy metal ions from an aqueous solution	21
3.4 Adsorption Studies	21
3.5 Optimization Studies	22
3.5.1 Effect of contact time	22
3.5.2 Effect of dosage	22
3.5.3 Effect of initial concentration	22
3.5.4 Effect of pH	23

CHAPTER 4 RESULT AND DISCUSSION

4.1	Fourier Transform Infrared Spectra of Hydrotalcite	24
4.1.1	FTIR Data	25
4.1.2	Result of FTIR	26
4.2	Inductive Coupled Plasma	26
4.2.1	Effect of contact time	27
4.2.2	Effect of pH	29
4.2.3	Effect of dosage	31
4.2.4	Effect of initial concentration	33
4.2.5	Adsorption isotherms	35
4.2.5.1	Langmuir isotherm	35
4.2.5.2	Freundlich Isotherm	37
4.2.5.3	Comparison between Langmuir and Freundlich isotherms parameter	39

CHAPTET 5 CONCLUSION

5.1	Conclusion	40
-----	------------	----

REFERENCES	41
-------------------	----

BIOGRAPHY	45
------------------	----

LIST OF TABLES

Table		Page
1.1	Interim Marine Water Quality Standards in Malaysia	2
1.2	Effluent Water Quality Standards of A and B in Industry of Malaysia	2
1.3	National Guidelines for Drinking Water Quality Standards	3
2.1	The properties of HT	11
4.1	Effect of contact time on the percentage uptake of cadmium (Cd^{2+})	28
4.2	Effect of initial pH on the percentage of uptake the cadmium by HT	30
4.3	Effect of dosage on the percentage uptake of cadmium (Cd^{2+}).	32
4.4	Effect of initial concentration (ppm) on the percentage uptake of cadmium by HT	34
4.5	$Q_e(\text{mg/g})$ against $C_e (\text{mg/L})$	36
4.6	Graph Log Q_e against Log C_e	38
4.7	Comparison between Langmuir and Freundlich adsorption.	39

ABSTRACT

UPTAKE CADMIUM (Cd^{2+}) BY ZnAlCO_3 HYDROTALCITE

Hydrotalcite is also known as layered double hydroxides (LDH) has an ability as adsorbent to adsorb metals such as cadmium. Its potential is depends on their interlayer ion that can hold and remove the cadmium metals. In this study, the ZnAl-CO_3 -HT was chosen to remove cadmium and it was prepared by co-precipitation method. Characterization of LDH was performed using FTIR. The uptake of cadmium was monitored by ICP. The adsorption studies were carried out by varying the parameters which include contact time, initial Cd concentration, initial pH, and adsorbent doze. The adsorption data fit both Langmuir and Freundlich isotherm. The Langmuir isotherm was better fitted to the data experiment. The adsorption capacity was found to be 6.618 mg/g.